

# CANOPY

## BIOGEOCHEMICAL CARBON, NITROGEN AND PHOSPHORUS FLUXES IN THE NORTH SEA

**Duration of the project:** 01/02/2002 – 30/04/2006

**Budget:** € 948.000

**Keywords:** Southern Bight of the North Sea, Carbon, Nitrogen, Phosphorus, Budgets

### CONTEXT

The Southern Bight of the North Sea receives carbon and nutrients from wastewater discharges, river inputs and atmospheric deposition. Sources of nutrients and carbon are mostly linked to anthropogenic activities. The nutrient enrichment of aquatic systems, also called eutrophication, results in an increased productivity. The most recent QSR report (OSPARCOM, 2000) for the Greater North Sea highlighted very high inputs of nitrogen and phosphorus to the North Sea. These nutrients and carbon are subject to internal fluxes and processes within the North Sea ecosystem, but recent average data for the North Sea dealing with these internal N, P and C recycling processes are rather scarce.

### PROJECT DESCRIPTION

Carbon and other nutrients are subject to internal fluxes and processes within the North Sea ecosystem, like internal recycling of organic and inorganic compounds, uptake by phytoplankton, mineralisation, atmospheric efflux, sedimentation, etc. Recent data for the North Sea, concerning this internal recycling are very limited. In this project we will reveal the relative importance of major processes involved in these internal carbon and nutrients cycles in the Southern Bight of the North Sea. These data will be integrated in box-models and compared to the input and output fluxes of C-N-P, in order to be able to visualise the global functioning of the concerned ecosystem. Furthermore, the significance of the main C-N-P compounds will be studied.

#### Objectives

The general objective of this project is to reveal the relative importance of major processes involved in the internal cycling of carbon and nutrients, in the Southern Bight of the North Sea. These data will be integrated in box-models and compared to the input and output fluxes of C-N-P, in order to be able to visualise the global functioning of the concerned ecosystem. Furthermore, the significance of the most important C-N-P compounds will be studied. Attention will be given to the improvement of analytical techniques, the validation of experimental protocols and the calculation of important ecosystem parameters.

#### Methodology

**1 Workpackage Uptake:** The goal of this workpackage is to quantify for the Southern Bight of the North Sea, on an annual basis, the importance of the transfer flux between the inorganic C-N-P pools and the living organic C-N-P pools (mainly phytoplankton). Experiments will be conducted in such a way that exactly the same conditions are valid for the 3 elements. This allows us to link the assimilation pathways of C, N and P.

**2 Workpackage Regeneration:** The goal of this workpackage is to quantify for the Southern Bight of the North Sea, on an annual basis, the importance of the transfer flux between the organic C-N-P pools and the inorganic C-N-P pools. For nitrogen, transformation rates will be calculated using a detailed 15N mass balance model (Elskens, 1999) allowing estimating the related uncertainties.

**3 Workpackage Pools and Speciation:** The first goal of this workpackage is to quantify, for the Southern Bight of the North Sea, the importance of the different pools of particulate/dissolved and organic/inorganic C-N-P, including their seasonal variability. This will be done by collecting data in existing databases and by implementing these by original measurements. Quality Assurance and quality control of the nutrient analysis is an essential requirement and therefore regular participation in the QUASIMEME nutrient inter-comparison exercises is necessary.

#### Interaction between the different partners

The 4 partners have each expertise in either the determination of N-fluxes (VUB), C-fluxes (ULB, VUB and ULg), P-fluxes (ULB) and in budgeting (RIKZ) so that they are complementary in the described workpackages.

#### Link with international programmes

This project is linked to the Dutch-Flemish collaboration project "The Balance between Heterotrophic and Autotrophic Processes in the Scheldt Estuary: Consequence for the Nitrogen Cycle".

#### Expected results and/or products

We expect that the results of this project will be able to answer some fundamental questions about the functioning of a highly men-influenced marine ecosystem: (1) How does the productivity of the Southern Bight of the North Sea reacts to the huge inputs of nutrients (2) What is the faith of the synthesised biomass? (3) What is the net CO<sub>2</sub> flux in the area? (4) What would be the possible result of a reduction of the nutrient supply?



## PARTNERS

### Activities

#### VUB

The department of Analytical and Environmental Chemistry (ANCH) has expertise in the determination of main fluxes concerning the nitrogen cycle in fresh-water and marine systems.

#### ULB

The Laboratory of Chemical Oceanography has expertise in the determination of main fluxes concerning the phosphorus cycle in marine systems.

#### ULg

The Unit of Chemical Oceanography has expertise in the field of air-sea CO<sub>2</sub> exchange and physico-chemistry of marine inorganic carbon.

#### RIKZ

Remi Laane has expertise in nutrient budgeting of marine systems and in data-bank management.

## CONTACT INFORMATION

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